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Clinical characteristics of Guillain-Barré syndrome in Shenzhen: a retrospective study

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Abstract

Background Guillain-Barré syndrome (GBS) is a group of immune-mediated peripheral neuropathies that causes acute flaccid paralysis. The global incidence of GBS was 0.6-4/100 000, and the incidence in China was 0.698/100 000. Although the diagnosis and treatment of GBS has made rapid progress, approximately 20% of patients with GBS are still unable to walk alone within 6 months after the onset of GBS, and 40% of patients have sequelae, such as weakened strength, limb pain, and numbness, seriously affecting their life and work. We aimed to retrospectively analyze the clinical characteristics of patients with GBS in Shenzhen, China and analyze the factors affecting disease severity to provide a reference for the precise treatment of GBS.

Methods Clinical data of inpatients diagnosed with GBS in several hospitals in Shenzhen from April 2010 to October 2021 were obtained from an electronic medical record system (HIS system). The clinical characteristics of patients with GBS and the factors affecting disease severity were analyzed.

Results A total of 146 patients were identified for this study, and 13 were lost during follow-up. During the follow-up period, three patients had acute-onset chronic inflammatory demyelinating polyneuropathy (A-CIDP). One hundred and thirty patients with complete data, comprising 90 males (69.23%) and 40 females (30.77%) with a median age of 39.50 ± 23.75 years, were included in the statistical analyses. Acute inflammatory demyelinating polyneuropathy (AIDP) was the most common electrophysiological variant (106 cases [81.54%]). Miller-Fisher syndrome (MFS), acute motor axonal neuropathy (AMAN), and acute motor-sensory axonal neuropathy (AMSAN) were noted in 21 (16.15%), 2 (1.54%), and 1 (0.77%) patients, respectively. The clinical course of the disease was mainly mild in 95 cases (73.08%), while 35 patients (26.92%) experienced severe disease. Logistic multivariate regression analysis showed that age ≥ 60 years old and having pneumonia may be associated with the severity of the disease.

Conclusions AIDP is the most common electrophysiological variant of GBS in Shenzhen. Most cases of GBS in our setting are mild, and the long-term prognosis is favorable. Old age (≥ 60 years) and having pneumonia are independent risk factors for severe GBS.

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Keywords Guillain-Barré syndrome, Prognosis, Severe disease

Background

Guillain-Barré syndrome (GBS) is a group of immune-mediated peripheral neuropathy that causes acute flaccid paralysis. The global incidence of GBS was 0.6–4/100 000, and the incidence in China was 0.698/100 000. Although the diagnosis and treatment of GBS has made rapid progress, approximately 20% of patients with GBS are still unable to walk alone within 6 months after the onset of GBS, and 40% of patients have sequelae, such as weakened strength, limb pain, and numbness, which seriously affect their life and work. The clinical manifestations of GBS are diverse, and the clinical characteristics of patients with GBS vary in different regions. Shenzhen is located in the southern end of China, and is predominantly composed of a floating population. The incidence of GBS is relatively low in Shenzhen, and the clinical characteristics are different from those in other regions. In treating the disease, the use of better treatment and nursing programs in its early stage can reduce the likelihood of a poor prognosis. Such enhancements in patient care include the delivery of individualized treatment, rehabilitation, and psychotherapy; strengthening nursing care for those with a poor prognosis; and considering the use of new experimental drug treatments. For both patients and their families, enhanced care includes providing timely information regarding the prognosis and reducing psychological stress and doubts. We aimed to help patients with GBS achieve maximum functional recovery and reduce disability.

Materials and methods

Study participants

We identified patients diagnosed with GBS from various hospitals in Shenzhen, China, between April 2010 and October 2021 through a search in the Shenzhen Electronic Record System (HIS system). All patient records were de-identified and anonymized, and clinical data of patients were only utilized in the retrospective analysis, which was in line with the ethical requirements of the Shenzhen Second People's Hospital. Ethical approval for this study was obtained from Shenzhen Second People's Hospital (KS20190529001). A total of 146 patients were identified from seven tertiary hospitals in Shenzhen. The tertiary hospitals covered four administrative districts: Futian, Luohu, Guangming, and Longgang- with a combined population of approximately 7.7 million individuals. The distribution of cases was as follows: 44 from Shenzhen Second People's Hospital; 35 from Peking University Shenzhen Hospital; 33 from Shenzhen People's Hospital; 12 from Longgang District Central Hospital; 7 from Longgang District People's Hospital; 5 each from Luohu District People's Hospital, Shenzhen Traditional Chinese Medicine Hospital, and Shenzhen Guangming District People's Hospital. Thirteen patients were lost to follow-up, and three patients with acute-onset chronic inflammatory demyelinating polyneuropathy (A-CIDP) were excluded from the analysis. Ultimately, 130 patients with complete data were included in the statistical analysis.

Inclusion and exclusion criteria

The following patients were included in the study: (1) those meeting the diagnostic criteria of GBS based on the 2019 Chinese Guidelines for diagnosis and treatment [1]; (2) those diagnosed with GBS for the first time; and (3) those with complete medical records. The exclusion criteria were as follows: (1) patients diagnosed with recurrent or chronic GBS; (2) those aged less than 14 years; (3) pregnant and lactating women; (4) the presence of other causes of muscle weakness, such as acute myelitis, periodic paralysis, myasthenia gravis, and polyneuritis caused by metals and poisons; and (5) patients who did not complete follow-up.

Collection of data and clinical outcomes

Data, such as sex, age, prodromal events, season of onset, history of hypertension or diabetes, and clinical signs and symptoms, were extracted. Investigation results such as cerebrospinal fluid (CSF) white cell count, CSF protein level, and CSF ganglioside antibody were also obtained. CSF samples were sent to the V-Medical Laboratory (Guangzhou, China) for testing. Western blots were used to detect anti-ganglioside antibodies. Findings on neuroelectrophysiological examination, medications administered on admission, and functional disability scores 6 months after disease onset were also collected. Autonomic dysfunction typically manifests as arrhythmia, vasomotor dysfunction, blood pressure fluctuation, urinary dysfunction, and intestinal dysfunction. Dysautonomia was recorded based on patient complaints, electrocardiography, blood pressure and residual urine measurements.

The following criteria were used for neural electrophysiological examination. The electrophysiological features of acute inflammatory demyelinating polyneuropathy (AIDP) were prolonged distal latency, slow conduction velocity, abnormal waveform dispersion and/or partial motor nerve block, and prolonged latency and/or decreased occurrence of the F wave. Acute motor axonal neuropathy (AMAN) features included decreased amplitudes of motor nerve conduction and compound muscle action potentials, with normal sensory nerve conduction.

Furthermore, motor unit recruitment is reduced in the early stages of the disease, and numerous abnormal spontaneous potentials are observed in the electromyography 1–2 weeks after disease onset. Thereafter, with nerve regeneration, the duration and amplitude of motor unit potentials increase, and multiphasic waves also increase. For acute motor-sensory axonal neuropathy (AMSAN), electrophysiological examination features primarily include decreased amplitudes of motor and sensory nerve action potentials. For patients with Miller-Fisher syndrome (MFS), electrophysiological findings are usually normal or only the amplitude of sensory nerve action potentials is reduced [2].

Clinical outcome was assessed using the Hughes Functional Grading Scale (HFGS), which is commonly used in clinical practice [3] and uses a scale ranging from zero to six to indicate varying levels of health and functioning. A score of zero signifies normal health, while a score of one denotes mild symptoms, with the individual still capable of walking independently and performing physical labor. Patients who can walk independently without crutches but are unable to perform physical labor receive a score of two. Walking with crutches or assistance from another person corresponds to a score of three, while individuals who are bedridden or confined to a wheelchair are assigned a score of four. Patients who require mechanical ventilation receive a score of five, and six signifies death.

The severity of the illness was determined based on the HFGS score at the peak of the disease. Patients with a score of ≤ 3 were classified into the 'mild disease' group, while those with a score of ≥ 4 were classified as severe disease [4].

Patients were followed up by telephone or during outpatient visits. The long-term prognosis was assessed at 6 months after disease onset. A favorable prognosis was defined as an HFGS score of < 3; a poor prognosis was defined as HFGS ≥ 3.

Statistical treatment

Excel 2016 software (Microsoft Corporation) was used for data capturing. Statistical packages for social sciences (SPSS) version 25.0 (IBM corporation) and Jomovi software were used for statistical analysis. Univariate analysis was performed using the chi-square test and multivariate analysis using non-conditional binary logistic regression. The test level was set at $\alpha = 0.05$.

Results

Clinical features of patients with GBS

Among the 130 patients included in this study, the male-to-female ratio was 2.25:1. The participants' age range was 14–82 years, and the median age was 39.50 (23.75) years old. Table 1 shows the distribution of demographic and clinical features among the study participants.

Univariate analysis of patients with mild and severe GBS

The results of the univariate analysis conducted on our retrospective data are shown in Table 2. We observed significant differences in age, history of diabetes, presence of cranial nerve damage, pneumonia, and autonomic nerve involvement between the mild and severe disease groups ($p < 0.05$).

Multivariate logistic regression analysis of clinical features according to disease severity

Multivariate unconditional binary logistic regression analysis was conducted with disease severity (categorized as mild and severe) serving as the dependent variable, while age, history of diabetes, cranial nerve damage, pneumonia, autonomic nerve involvement, and other variables were considered as independent variables. The first level of each independent variable was used as a reference. Our findings revealed significant differences in disease severity with advanced age, cranial nerve damage, and pneumonia ($p < 0.05$). Being aged 60 years or older (odds ratio [OR] = 3.453, 95% confidence intervals [95%CI]: 1.190–10.023) and having pneumonia (OR = 5.546, 95%CI: 1.665–18.474) were identified as potential risk factors for severe disease (Table 3).

Discussion

Findings from our study reveal that most patients with GBS in Shenzhen are male between the ages of 20–60 years, with symptoms occurring in spring and summer. Respiratory infections were identified as the main prodromal events. Initial symptoms typically included limb weakness and abnormal sensations in the limbs, often accompanied by cranial nerve damage and autonomic involvement. AIDP emerged as the predominant type of GBS in our setting. The severity of GBS tended to be mild, with a favorable long-term prognosis. An age of 60 years and older and pneumonia were identified as independent risk factors for developing severe GBS.

GBS occurs globally, with epidemiological surveys indicating a global incidence ranging from 0.6 to 4 per 100,000 people. The incidence of GBS varies across different regions due to differences in environmental conditions, economic status, healthcare infrastructure, and public health awareness and behaviors. While the overall incidence of GBS in Western countries ranges from 1.1 to 1.8 per 100,000 individuals [5], the incidence in China is 0.698 per 100,000. In Chinese children, the incidence of GBS is much lower, at 0.233 per 100,000, than that in adults, wherein the incidence rate is 0.829 per 100,000 [6]. Men exhibit a higher risk of developing GBS than women, with a male-to-female ratio of approximately 1.5:1 [7]. The high male-to-female ratio, suggesting an increased incidence of GBS in males, is consistent with previous reports [8]. The median age of GBS onset was

Table 1 Clinical features of patients with GBS

Group		*N*	Proportion (%)
Sex			
	Male	90	69.23
	Female	40	30.77
Age			
	< 60 y	107	82.31
	≥ 60 y	23	17.69
Season of disease onset			
	Spring or summer	81	62.31
	Autumn or winter	49	37.69
History of chronic diseases			
	Hypertension	19	14.62
	Diabetes	9	6.92
Precursor event			
	Yes	78	60
Duration of disease before admission	< 2 weeks	96	73.85
	≥ 2 weeks	34	26.15
Clinical symptoms			
	Isolated limb weakness	27	20.77
	Pure limb paresthesia	8	6.15
	Limb weakness with associated limb paresthesia	38	29.23
	Combined with cranial nerve damage	57	43.85
Limb tendon reflexes			
	Weaken/fade away	119	91.50
	Normal	9	6.92
	Tendon hyperreflexia	2	1.54
Autonomic nerve involvement			
	Yes	20	15.38
	No	110	84.62
Pneumonia			
	Yes	17	13.08
	No	113	86.92
Duration of disease before lumbar puncture			
	≤ 2 weeks	82	63.08
	> 2 weeks	48	36.92
CSF white blood cell count (*10^6/L)			
	< 5	96	73.85
	5–10	21	16.15
	11–30	11	8.46
	> 30	2	1.54
CSF Protein level (mg/dL)			
	≥ 45	111	85.38
	< 45	19	14.62
Ganglioside antibody detection			
	Positive	22	16.92
	Negative	21	16.15
	Unknown	87	66.92
Electrophysiological classification			
	AIDP	106	81.54
	MFS	21	16.15
	AMAN	2	4.54
	AMSAN	1	0.77
Disease severity			
	Mild	95	73.08

Table 1 (continued)

Group		*N*	Proportion (%)
	Severe	35	26.92
Medication administered			
	IVIG	55	42.31
	Glucocorticoid	23	17.69
	IVIG + Glucocorticoid	47	36.15
	PE	2	1.54
	None	3	2.31
Long-term prognosis			
	Favorable	120	92.31
	Poor prognosis	10	7.69

CSF, cerebrospinal fluid; AIDP, acute inflammatory demyelinating polyneuropathy; MFS, miller-fisher syndrome; AMAN, acute motor axonal neuropathy; AMSAN, acute motor-sensory axonal neuropathy; IVIG, intravenous immunoglobulin; PE, plasma exchange

Table 2 Univariate analysis of clinical features according to disease severity

Group	Mild [*n* (%)]	Severe [*n* (%)]	c^2	*p*-value
Sex				
M	65 (72.22)	25 (27.78)	0.1086	0.742
F	30 (75.00)	10 (25.00)		
Age				
< 60 y	83 (77.57)	24 (22.43)	6.2058	0.013*
≥ 60 y	12 (52.17)	11 (47.83)		
Season				
Spring and summer	63 (77.78)	18 (22.22)	0.154	0.089
Autumn and winter	32 (65.31)	17 (34.69)		
Hypertension				
Yes	11(57.89)	8(42.11)	2.607	0.106
No	84(75.68)	27(24.32)		
Diabetes				
Yes	3(33.33)	6(66.67)	7.763	0.005*
No	92(76.03)	29(23.97)		
Lumbar puncture distance time				
< 2 weeks	66(68.75)	30(31.25)	3.4929	0.062
≥ 2 weeks	29(85.29)	5(14.71)		
Combined cranial nerve damage				
Yes	47(82.46)	10(17.54)	4.5386	0.033*
No	48(65.75)	25(34.25)		
Autonomic nerve involvement				
Yes	11(55.00)	9(45.00)	3.9258	0.048*
No	84(76.36)	26(23.64)		
Pneumonia				
Yes	7(41.18)	10(58.82)	10.1159	0.001*
No	88(77.88)	25(22.12)		

*denotes statistically significant values

51 years, with a peak at ages 50 to 69 years [8]. In aging Europe and North America, GBS is most common in people between 50 and 80 years of age, whereas studies from Asia, South America, and sub-Saharan Africa show that GBS most commonly occurs in people between 21 and 35 years of age [9]. The age distribution observed in our study likely reflects Shenzhen's status as an immigrant city with a predominantly young population. Univariate analysis revealed a significant difference in the age composition between the mild and severe disease groups ($c^2 = 6.2058$, $P = 0.013$). Logistic regression analysis showed that age 60 years and above was an independent risk factor for severe disease, with older age correlating with a more severe clinical condition (OR = 3.453, 95%CI: 1.190–10.023). One explanation for this may be the reduced ability for myelin regeneration and slower recovery from peripheral injury associated with advanced age.

The incidence of GBS shows seasonal variation. In Europe, GBS mainly occurs in summer and autumn, whereas a study in India noted a higher occurrence in spring and summer, accounting for approximately 60% of all GBS cases [9]. Our study also observed a predominance of GBS cases during spring and summer. However, GBS severity did not exhibit a significant correlation with the season of onset. This finding may be attributed to the spike in upper respiratory tract and gastrointestinal infections in spring and summer, alongside the slight seasonal difference experienced in Shenzhen. Approximately 50–75% of patients with GBS experience prodromal events up to 4 weeks before GBS onset, with

Table 3 Multivariate logistic regression analysis of study variables

Variable	B	S.E.	Wals	*P*	OR	95% C.I.	
						Lower	Upper
Age	1.239	0.544	5.196	0.023	3.453	1.190	10.023
Diabetes	1.386	0.856	2.623	0.105	4.000	0.747	21.410
Combined with cranial nerve damage	-1.223	0.494	6.126	0.013	0.294	0.112	0.775
Pneumonia	1.713	0.614	7.785	0.005	5.546	1.665	18.474
Autonomic nerve involvement	-1.026	0.606	2.868	0.090	0.358	0.109	1.175

Campylobacter jejuni being the most implicated infectious agent [10]. In Europe, North America, East Asia, and Southeast Asia, upper respiratory tract infections (35%) accounted for the majority of GBS cases, whereas in Bangladesh, gastrointestinal infections (27%) are more common [11]. Numerous infectious disease outbreaks worldwide, such as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic of 2019 (COVID-19), have confirmed that infections are related to the occurrence of GBS [12]. In our study, 10 cases were collected after the COVID-19 outbreak, and the incidence of GBS decreased after the pandemic. However, the small number of cases is a limitation of this study, and further large-scale investigations are warranted to validate the effects of COVID-19 on the incidence of GBS. Additionally, non-infectious factors, including vaccination, surgery, pregnancy, immunosuppression, and the use of exogenous gangliosides, contribute to GBS prodromal events [13]. In our study, 60% of patients experienced prodromal events, mainly upper respiratory tract infections, while non-infectious factors accounted for a smaller proportion.

The clinical manifestations of GBS are diverse, and the initial symptoms typically include sudden symmetrical limb weakness, terminal limb numbness, pain, or cranial nerve involvement. Weakened or absent limb tendon reflexes are common signs of GBS, although some patients present with normal or hyperactive reflexes, as observed in AMAN and Bickerstaff brainstem variants [14]. Studies have shown that cranial nerve involvement occurs in 50% of the patients with GBS, often manifesting as bilateral facial muscle weakness, bulbar weakness, or extraocular muscle paralysis. Furthermore, 19% of patients require ventilator assistance [15]. Autonomic dysfunction affects 38–70% of patients, with common symptoms including intestinal obstruction (42%), hypertension (39%), hypotension (37%), fever (29%), tachycardia or bradycardia (27%), and urinary retention (24%), as reported by Chakraborty [16]. Studies suggest that cranial nerve damage, especially bulbar muscle weakness and autonomic involvement, are risk factors for severe GBS and poor prognosticators [17]. Our univariate analysis indicated a relationship between cranial nerve and autonomic involvement and GBS severity, while logistic regression analysis identified cranial nerve involvement as a protective factor against severe GBS. This discrepancy may be attributed to our small sample size.

The occurrence of pneumonia during the disease course was identified as a risk factor for severe GBS, emphasizing the importance of promptly diagnosing and treating pneumonia to improve disease outcomes. The presence of cytoalbumin dissociation in the CSF is an important feature of GBS. The white cell count in the CSF of patients with GBS is usually normal, and the presence of marked leukocytosis (> 50 cells per microliter) suggests another disease, such as leptomeningeal malignancy or an infectious or inflammatory disease of the spinal cord or nerve roots. CSF protein levels usually range between 45 and 200 mg/dL; however, in some cases, the level may reach as high as 1000 mg/dL. The presence of cytoalbumin dissociation depends on the disease duration, with 10–30% of patients exhibiting normal CSF protein content during the second week of illness [14]. In our study, cytoalbumin dissociation in the CSF of our participants was primarily observed during the second to third weeks after the onset.

Serological testing for anti-ganglioside antibodies is not mandatory for diagnosis, as a negative test result does not rule out GBS. However, special antibodies can be present in some variants of GBS. In particular, anti-ganglioside antibodies can lead to the destruction of the blood-nerve barrier and infiltration of inflammatory cells from the periphery, resulting in further nerve damage. In many cases, patients with GBS who tested positive for anti-ganglioside antibodies experience increases in IgG levels due to the blood-brain barrier and nerve root damage. Furthermore, antibodies may diffuse from the peripheral to the central circulation, which can slow or block conduction. Thus, the presence of anti-ganglioside antibodies in serum and CSF may suggest a special type of GBS [18].

Some studies have demonstrated that patients with AMAN and AMSAN often have IgG anti-GM1 and anti-GD1a antibodies and that the presence of anti-GM2 antibodies is associated with a recent cytomegalovirus infection. Anti-GalNAc-GD1a and anti-GD1b antibodies are associated with axonal type GBS [19]. Additionally, the presence of IgG anti-GQ1b antibodies is useful in diagnosing MFS, with a sensitivity of 85–90%, and is also found in Bickerstaff brainstem encephalitis (BBE), pharyngeal-cervical-brachial variant, and other patients with GBS and ophthalmoplegia [20]. In our study, CSF from 43 (33.07%) patients were tested for antiganglioside antibodies, with 22 (16.92%) testing positive. The anti-ganglioside antibodies evaluated in this study were mainly anti-GM1, GM2, GD1a, and GQ1b.

GBS is a heterogeneous syndrome with multiple variants and a wide spectrum [21]. AIDP accounts for 85–90% of cases in the United States and Europe, while AMAN dominates in developing countries. Doets et al. [22] found that MFS is more prevalent in Asian countries. Previous studies have highlighted that in China, AMAN is the most common type of axonal injury in GBS [23]. However, given China's vast territory, the incidence of AIDP and AMAN varies across regions. Notably, AMAN is the predominant type in northern China, accounting for 55.3% of GBS cases, while AIDP prevails in southern China.

Intravenous immunoglobulin (IVIG) and plasma exchange (PE) are the only known immunotherapeutic approaches that accelerate recovery from GBS. Clinical trials have demonstrated the efficacy of IVIG administered within two weeks of onset and PE within four weeks, with both treatments yielding comparable outcomes [24]. Several clinical studies have confirmed that glucocorticoids alone or in combination with IVIG are not effective. Currently, national and international guidelines do not recommend glucocorticoids for the treatment of GBS. Administering a second course of IVIG therapy in patients with a poor prognosis has not been proven to be effective. In our study, IVIG (42.31%) was the most common treatment, with a large proportion also receiving IVIG combined with glucocorticoids. This trend may be influenced by the progression of GBS, patients' economic level, and clinicians' lack of up-to-date knowledge.

Globally, most patients with GBS achieve good recovery, with 77% walking independently at 6 months and 81% at 12 months, with over 50% achieving full recovery [25]. Although GBS has a favorable prognosis, statistics reveal that 40% of patients experience varying degrees of weakness, limb pain, numbness, and other complications, significantly impacting work efficiency and quality of life. The favorable long-term prognosis of the participants in this study may be related to the predominance of young patients in this region, minimal climatic variation, dominance of AIDP as the main phenotype, and generally mild symptoms of GBS.

Due to the extended timeframe within which cases were recruited in this study, some patients had vague memories and could not accurately describe details about their specific recovery, potentially introducing recall bias. Other limitations of our study include the relatively small sample size and the lack of specific pathogen serological test results across different seasons.

Conclusion

Although GBS has been known for a long time, with most patients treated successfully, its pathogenesis is still not completely understood, and many patients still experience varying degrees of sequelae, warranting further research in the future.

Abbreviations

95%CI	95% confidence intervals
AIDP	Acute inflammatory demyelinating polyneuropathy
AMAN	Acute motor axonal neuropathy
AMSAN	Acute motor-sensory axonal neuropathy
CSF	Cerebrospinal fluid
GBS	Guillain-Barre syndrome
HFGS	Hughes functional grading scale
IVIG	Intravenous immunoglobulin
MFS	Miller-fisher syndrome
OR	Odds ratio
PE	Plasma exchange

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Author contributions

GF and YQY extracted the data, performed the analysis, and wrote the first draft of the manuscript. WX, GH, SX and ZJ provided supervision to the study and were major contributors in writing the manuscript. RL and ZY acquired the funding for the study and conceptualized the study. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate

All patient records were de-identified and anonymized, and clinical data of patients were only utilized in the retrospective analysis, which was in line with the ethical requirements of the Shenzhen Second People's Hospital. Ethical approval for this study was obtained from Shenzhen Second People's Hospital (KS20190529001). Due to the retrospective nature of this study, patient consent to participate was not obtained.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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